Aquatic Sciences Meeting, Palma, 2023-06-05
T Panaïotis, A Poteau, É Diamond-Riquier, L Courchet, S Motreuil, C Catalano, L Coppola, M Picheral and JO Irisson

Temporal evolution of particles and plankton distributions across a mesoscale front during the spring bloom

Describe community dynamics during the *bloom* over a *front*

What we know

Bloom in **Feb-March**

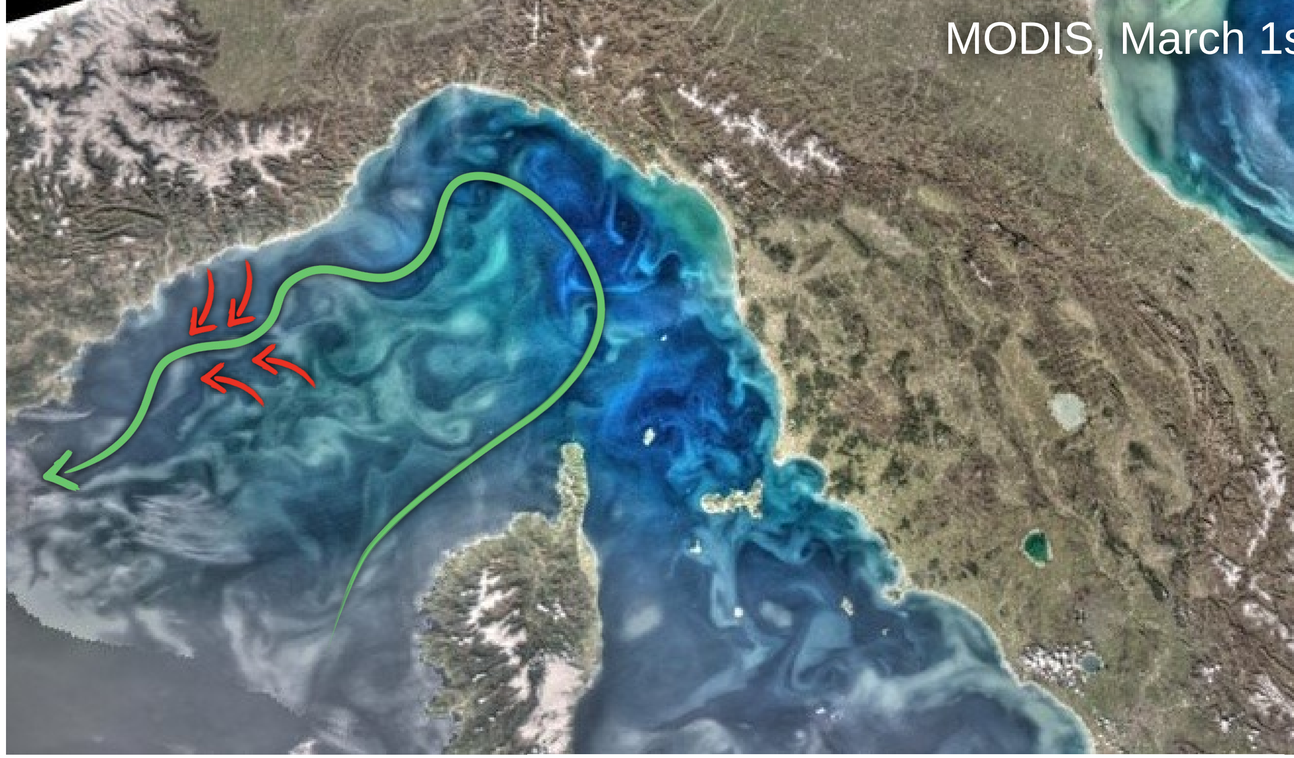
Succession: phytoplankton → zooplanktonic grazers → zooplanktonic predators

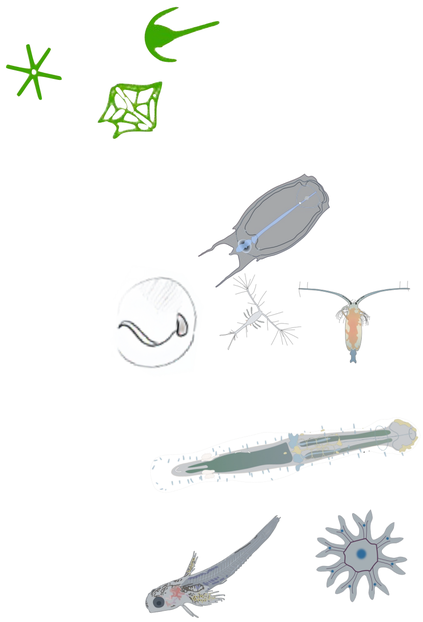
Ends with stratification, **oligotrophy** of surface and creation of Deep Chlorophyll Maximum

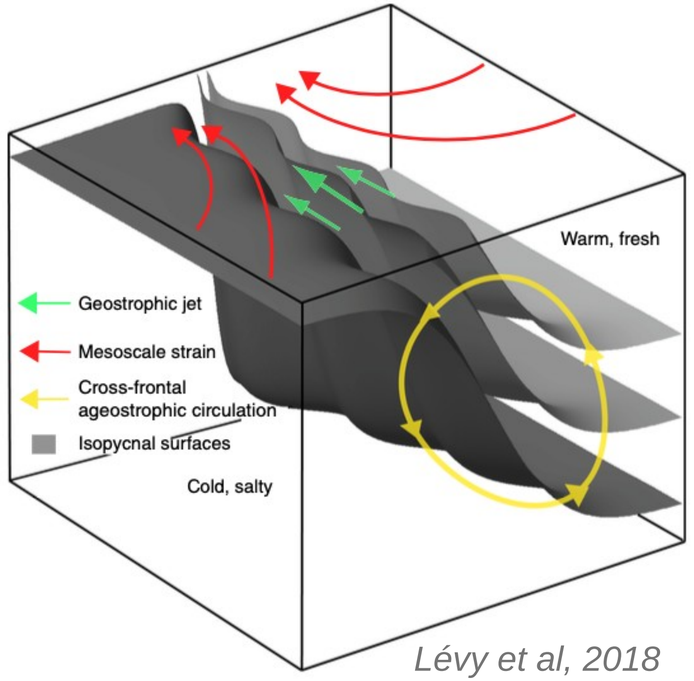
Permanent front, including **submesoscale** recirculation

Increased productivity and/or aggregation

Constrains **particle** distribution possibly **plankton**







Lévy et al, 2018

Needs

Okm resolution

several months

biogeochemistry → zooplankton

⇒

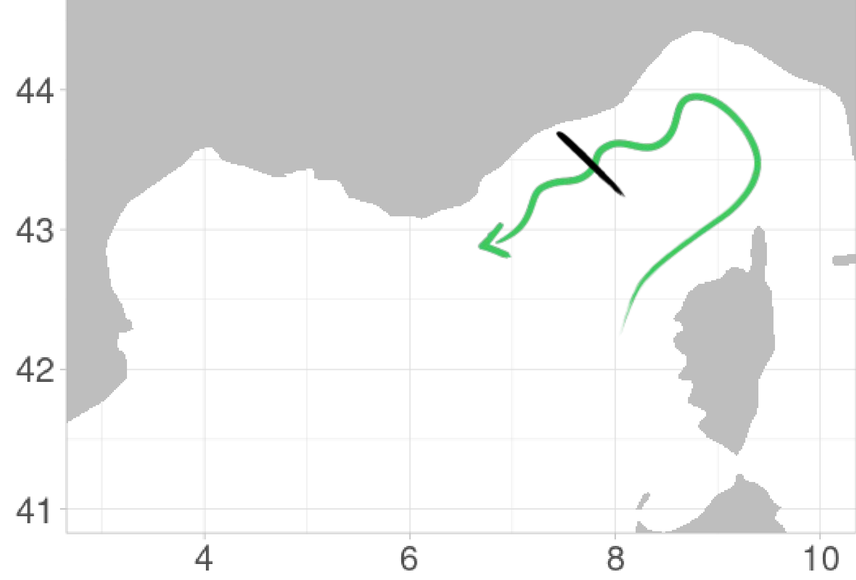
Glider + UVP6

Tº, sal

O_2, Chl a, CDOM, BB700

UVP6 LP
particles > 80 µm
organisms > 0.6 mm

Sampling strategy



Ligurian current

~1km

Coast

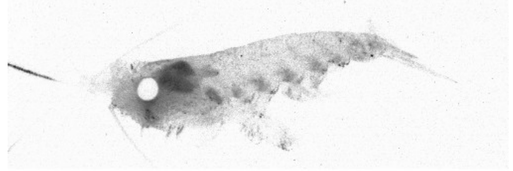
Offshore

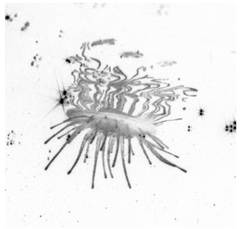
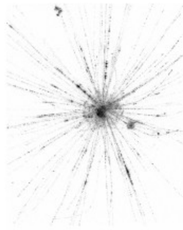
300 m

600 m

Glider campaign overview

5000 profiles
1.1 million images



J 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

F 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

M 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

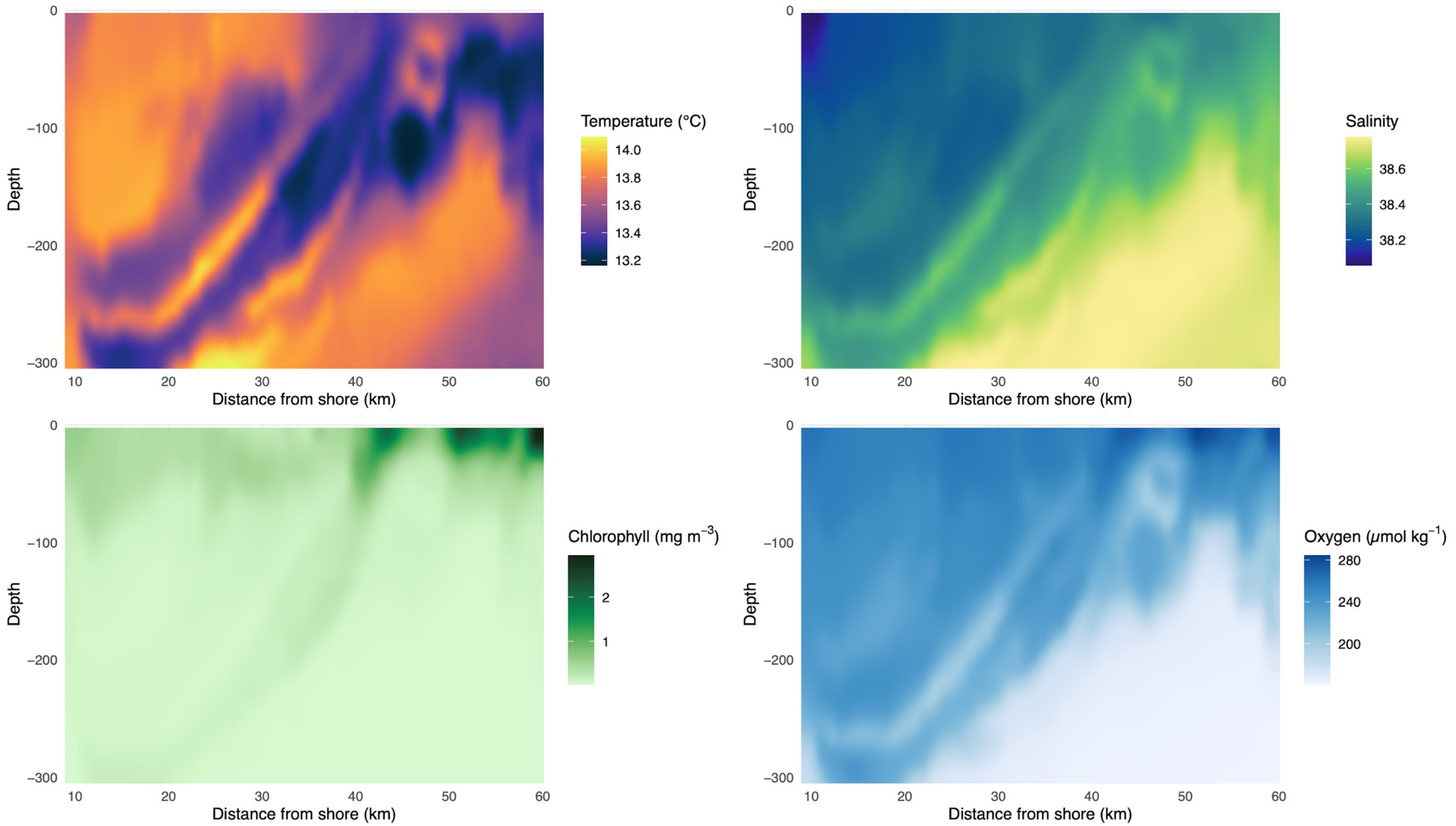
A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

M 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

J 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

out back

Biogeochemical data



Some sensors result in quite **noisy** data

Filter out outliers, despike through moving median

Bin 5 m depth

Smooth through moving average

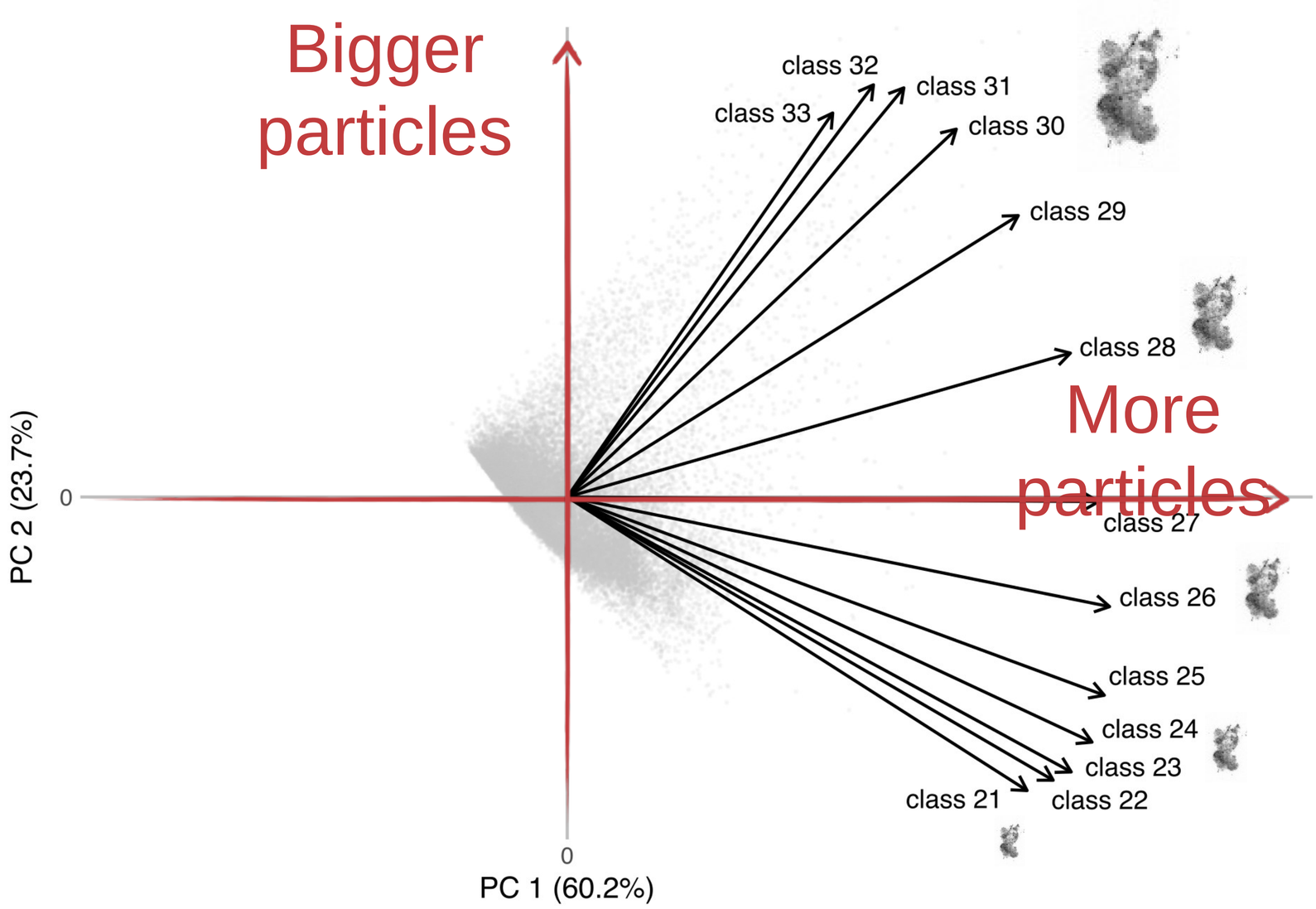
Interpolate over the whole domain (200 m in x, 0.5 m in y)

Particle data

13 particle **size classes**

PCA on log-transformed particle concentrations

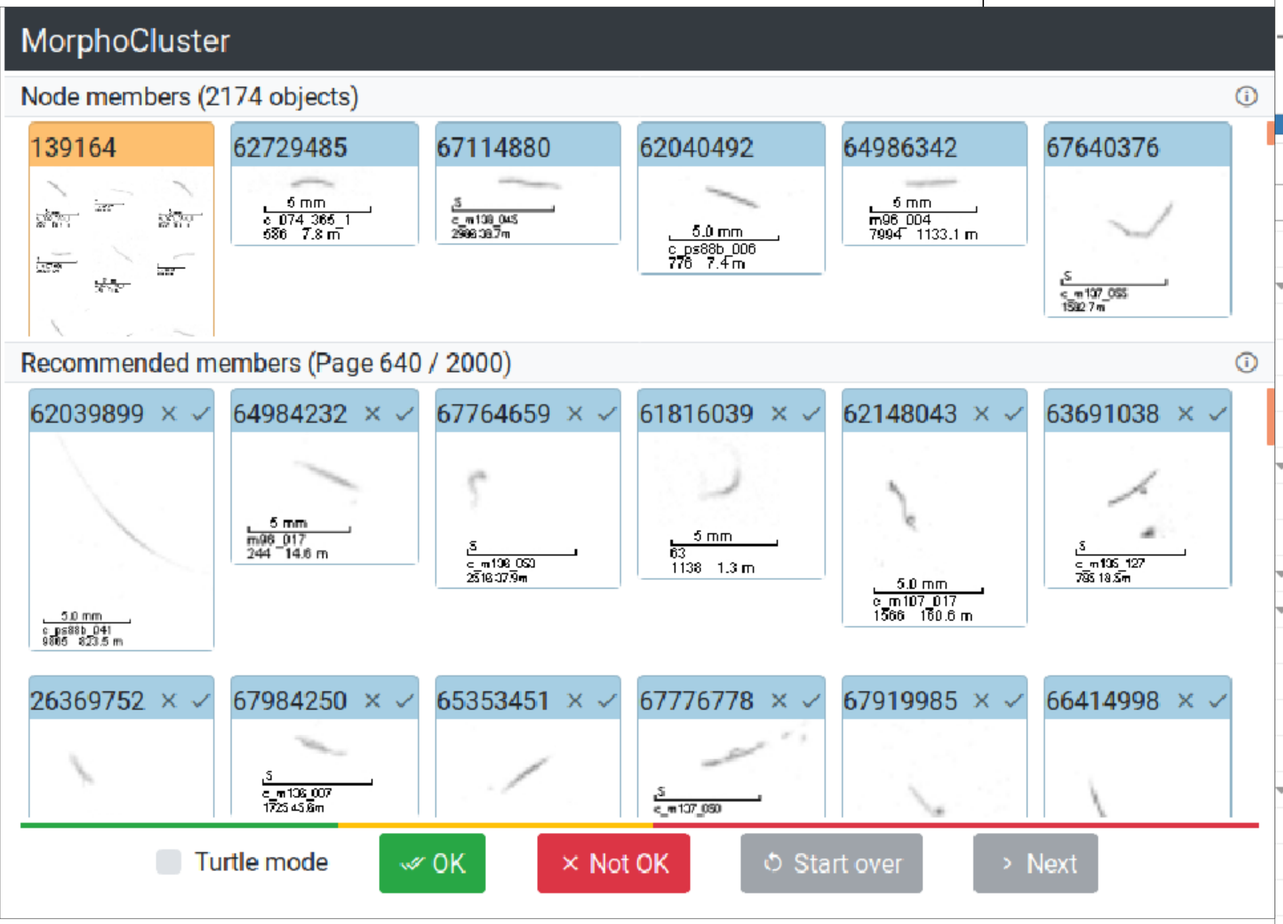
Summarised by the first two components

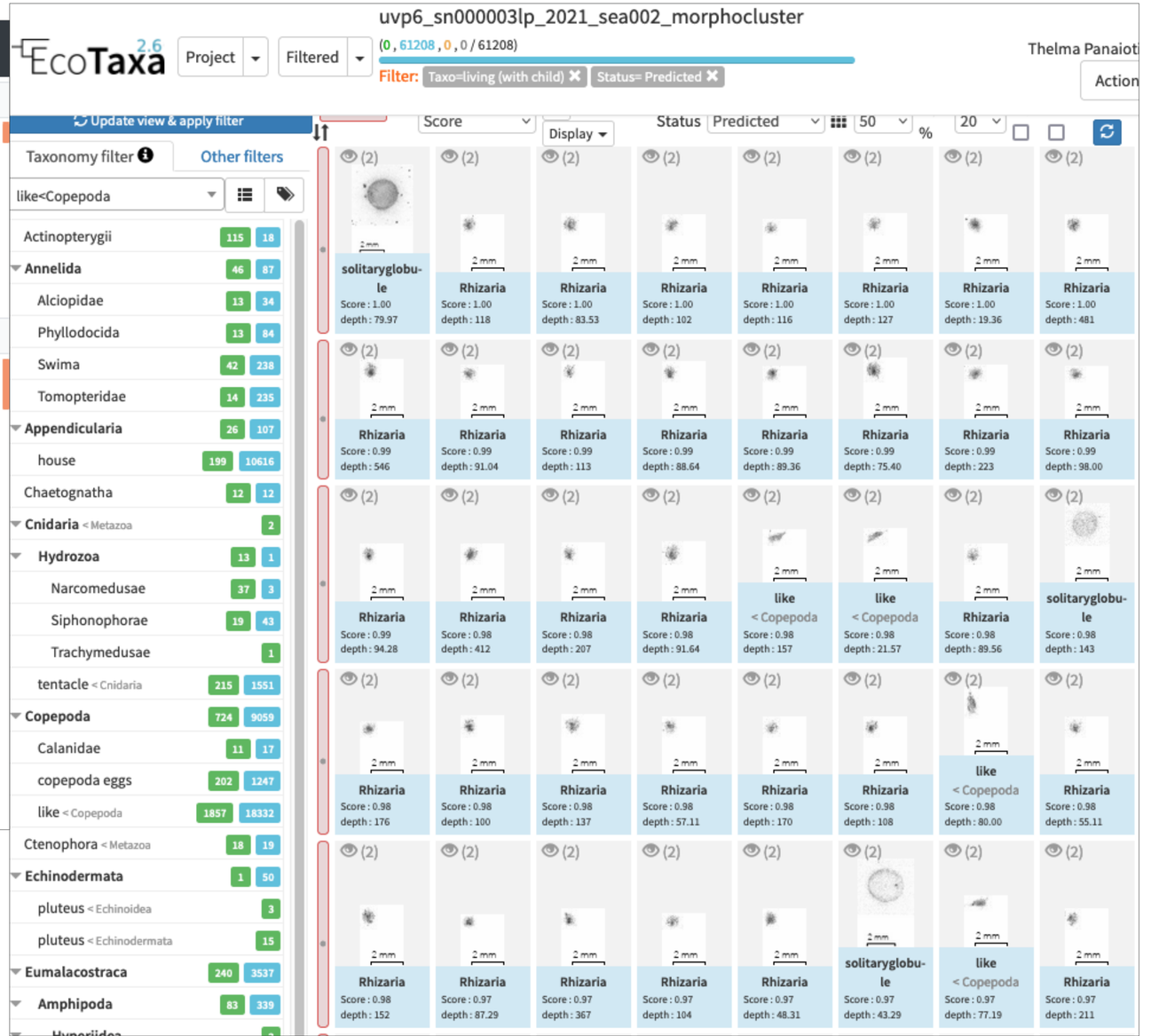


Plankton data

Machine Learning predictions + Morphocluster and EcoTaxa

13,000 planktonic organisms = concentrations on 20m × 5km bins





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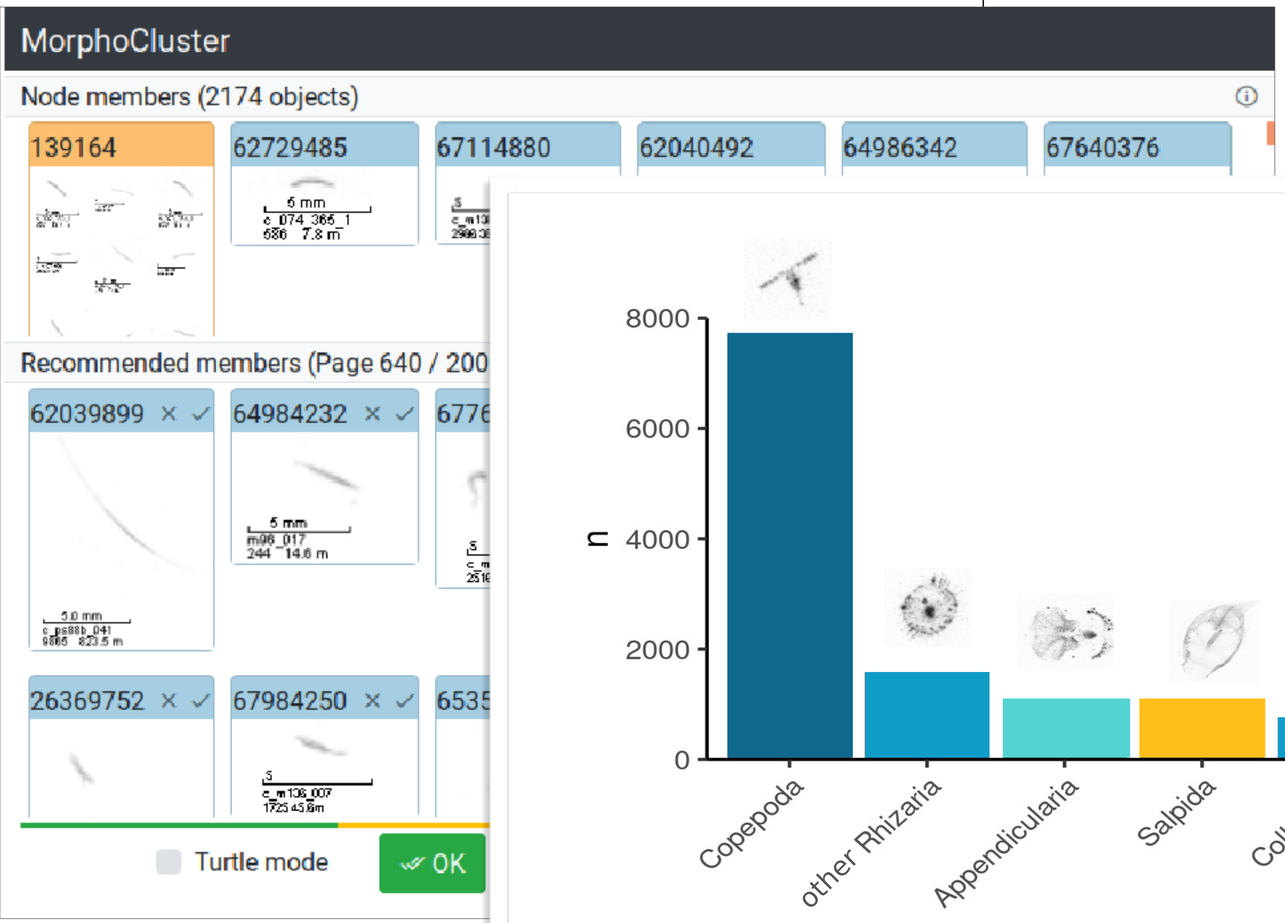
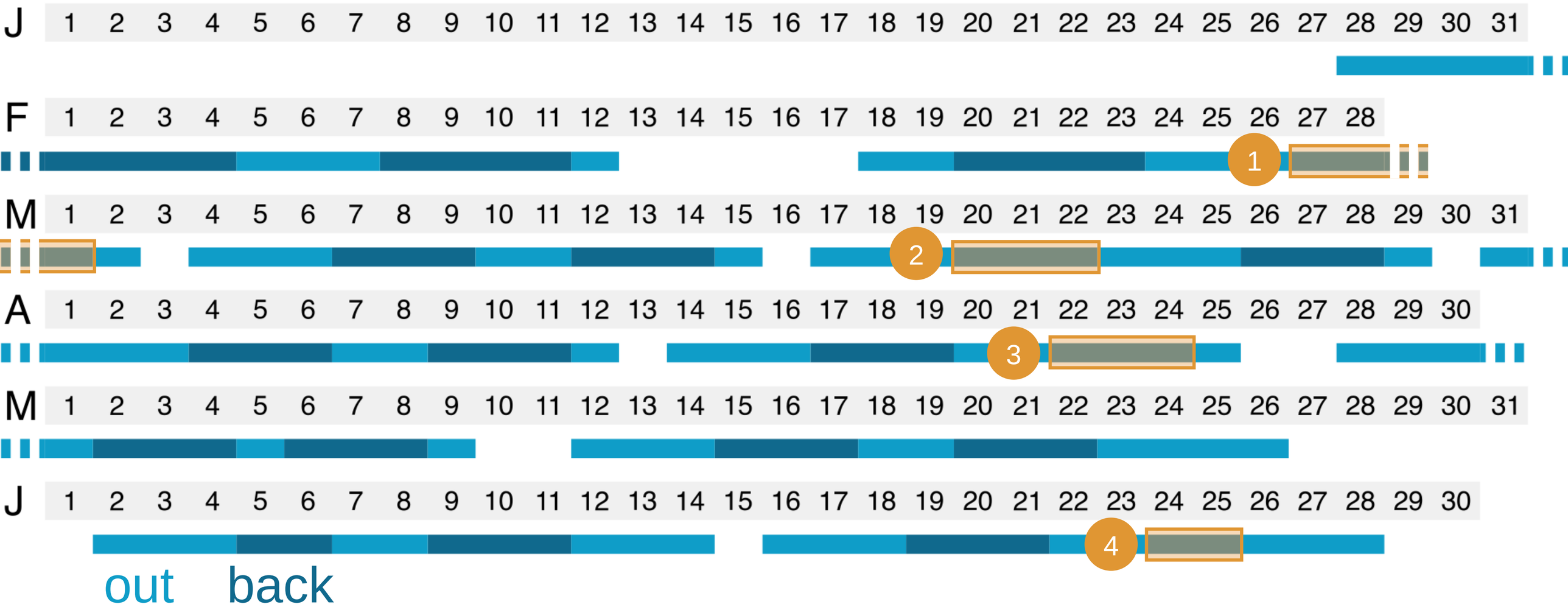
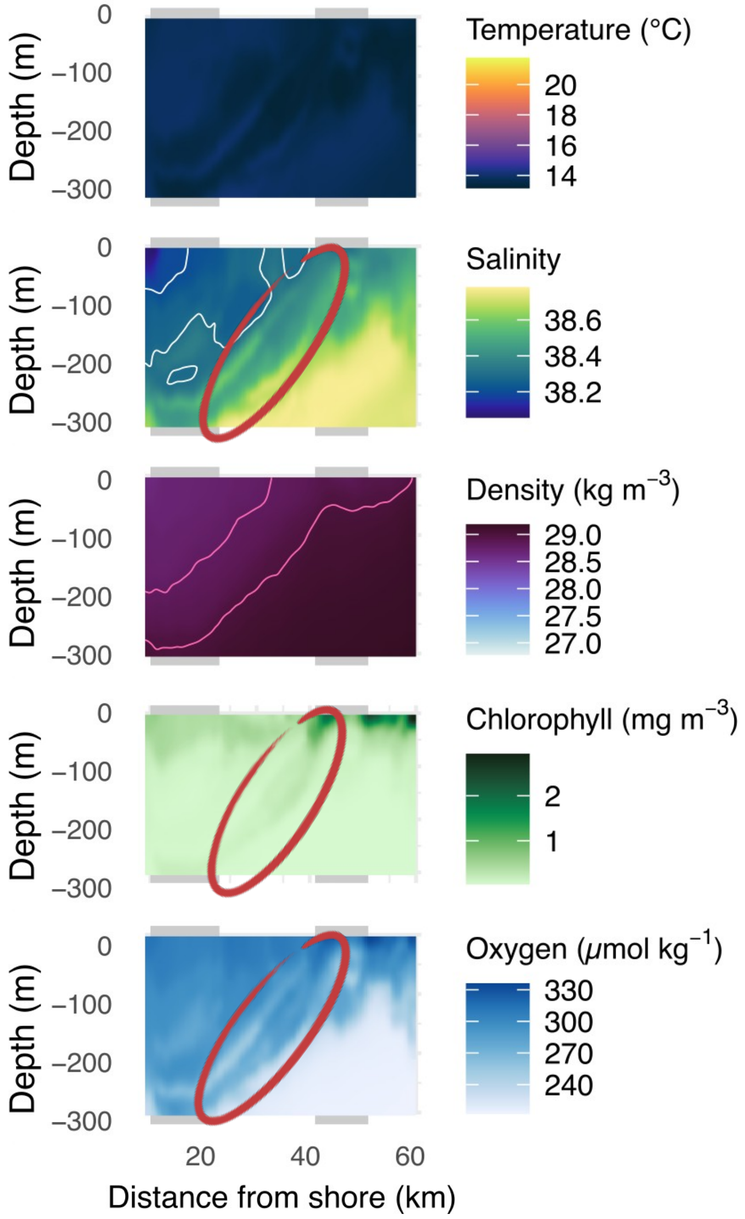


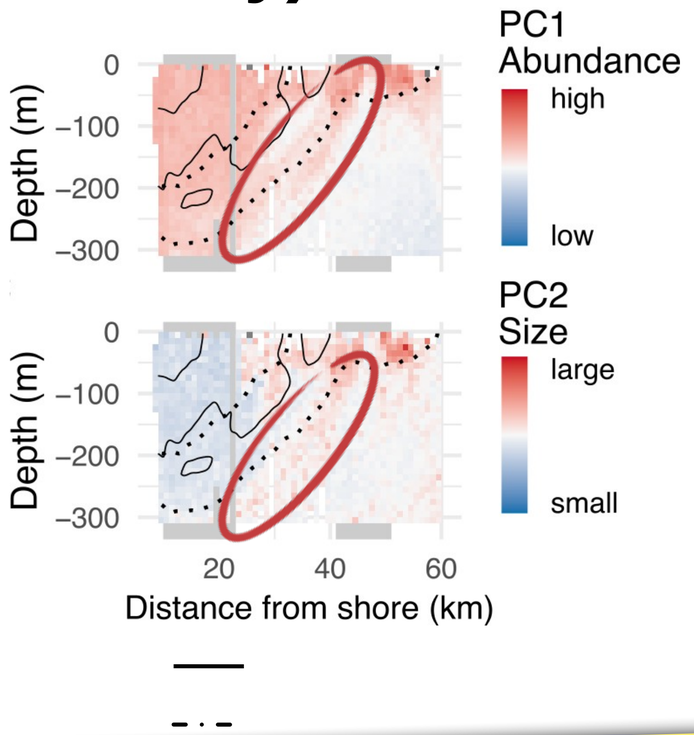
Selection of transects

1: **early** bloom 2: **mid** bloom 3: **late** bloom 4: **post** bloom



1: Early bloom (late February)

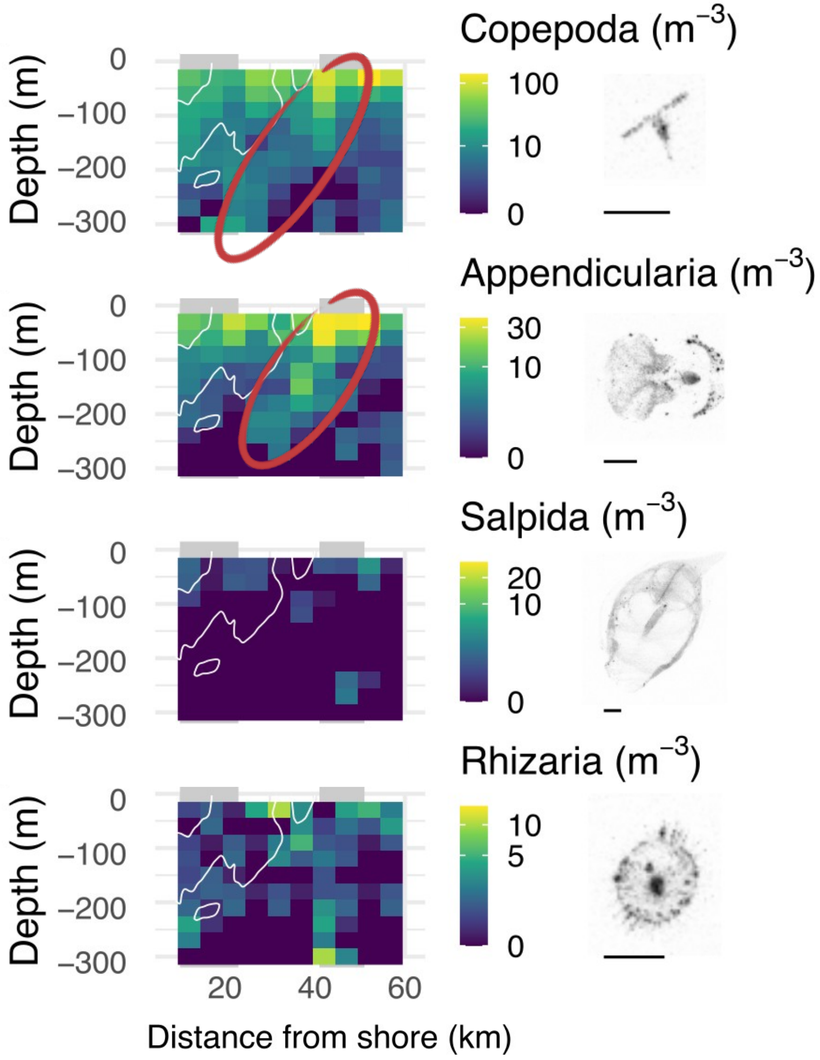




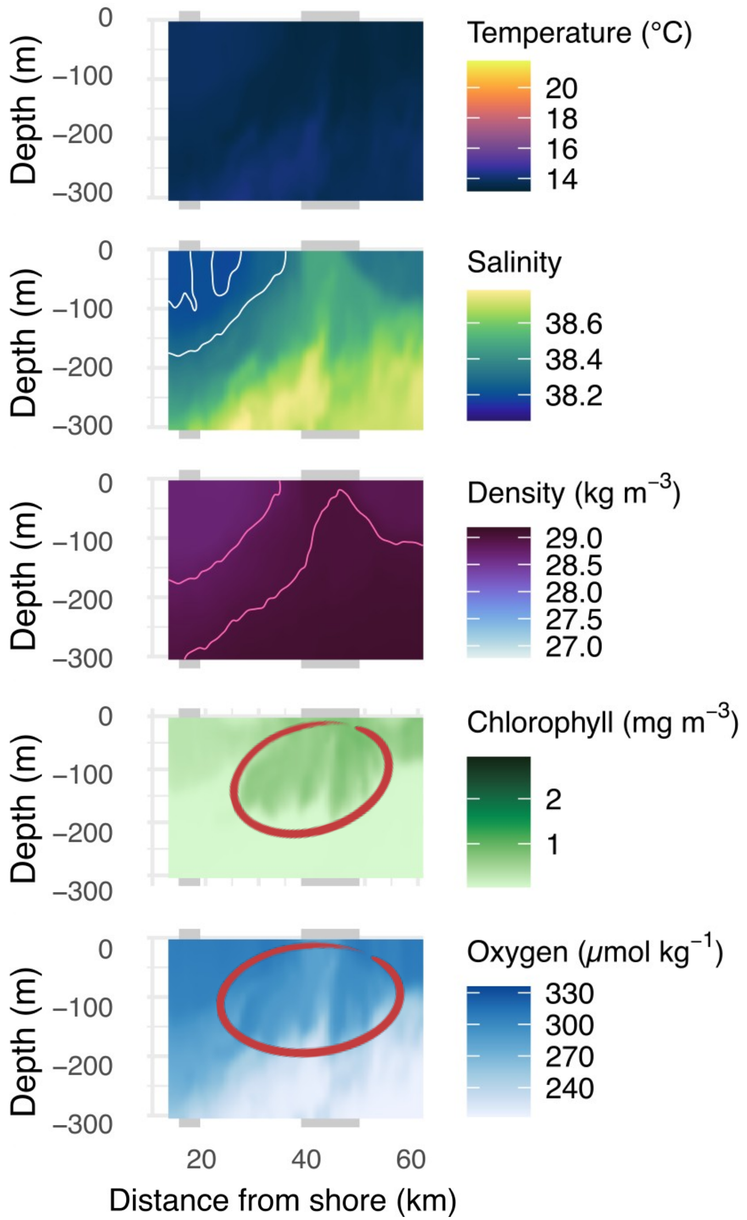
Subducting waters

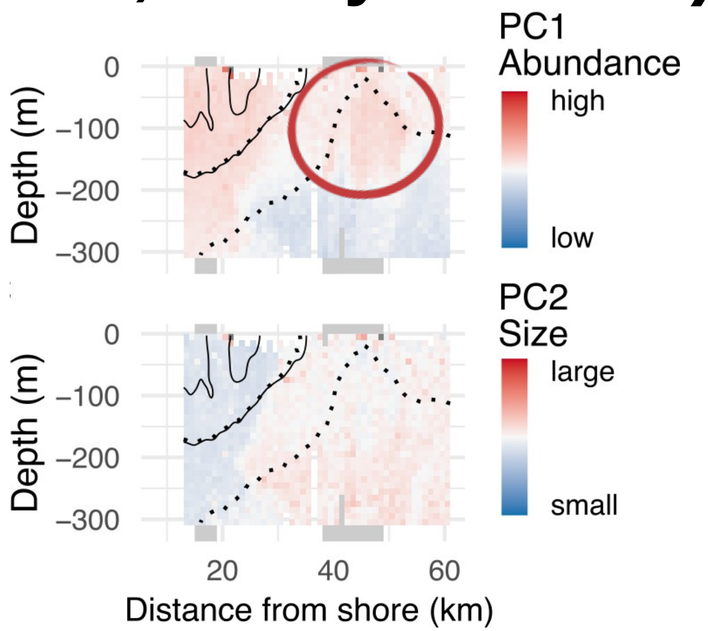
…affecting particles, Copepods and Appendicularia

Discarded houses



2: Mid bloom (late March, windy weather)

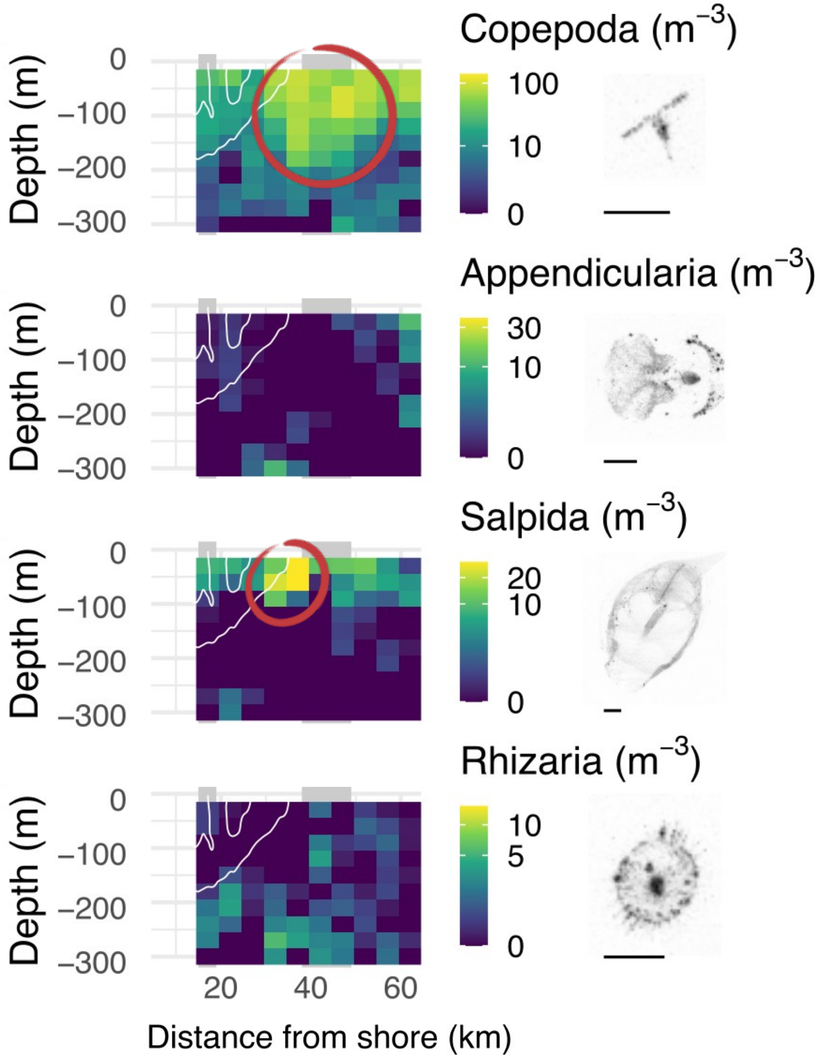




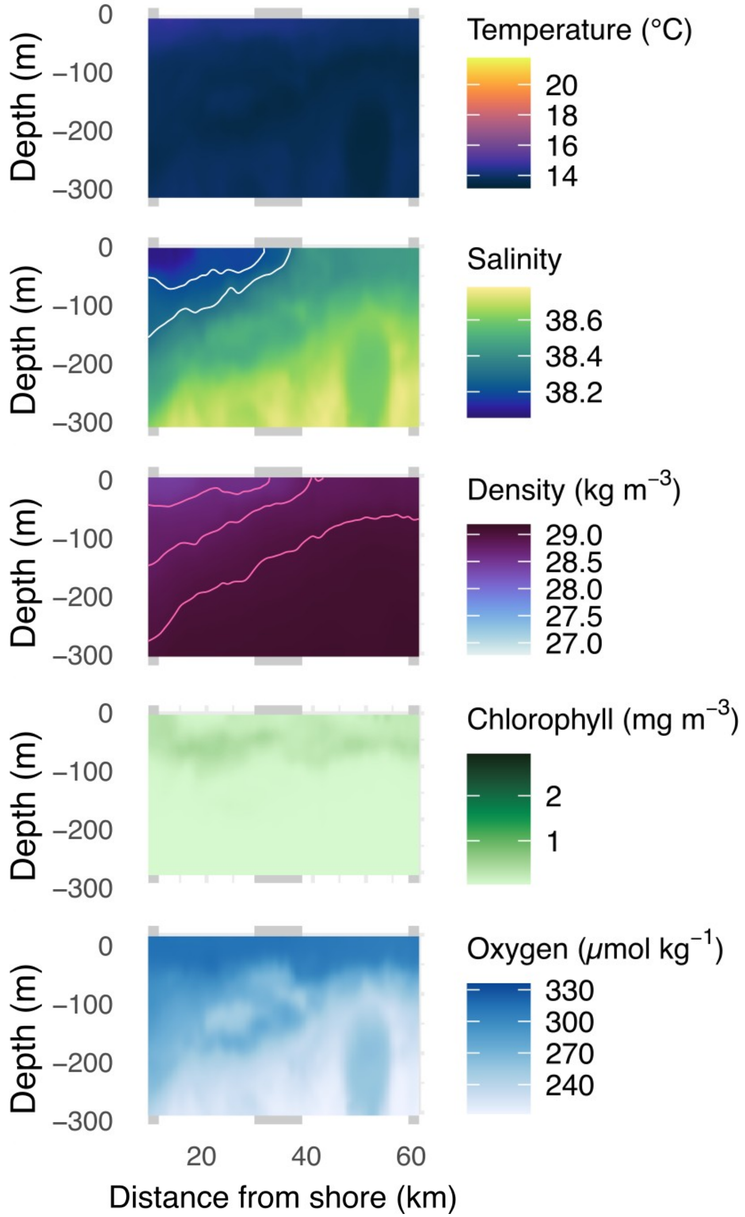
Mixing event affecting particles and plankton

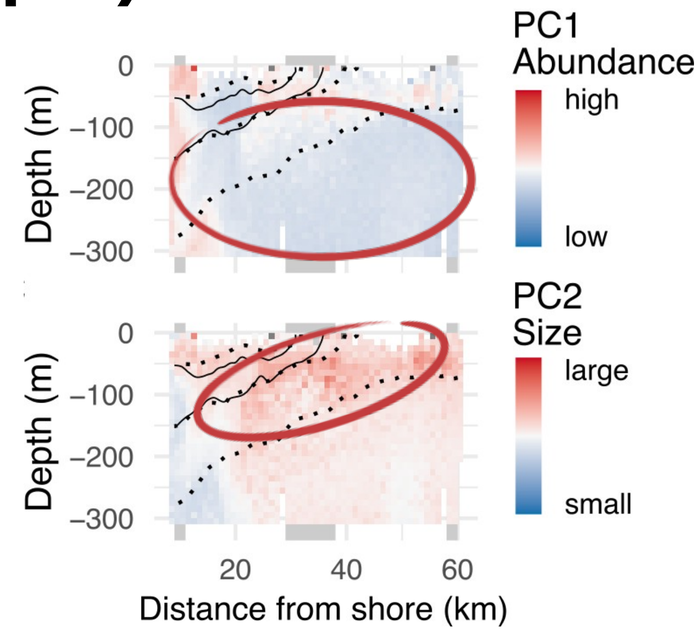
Appendicularians → Salps

Concentration increase at front



3: Late bloom (late April)

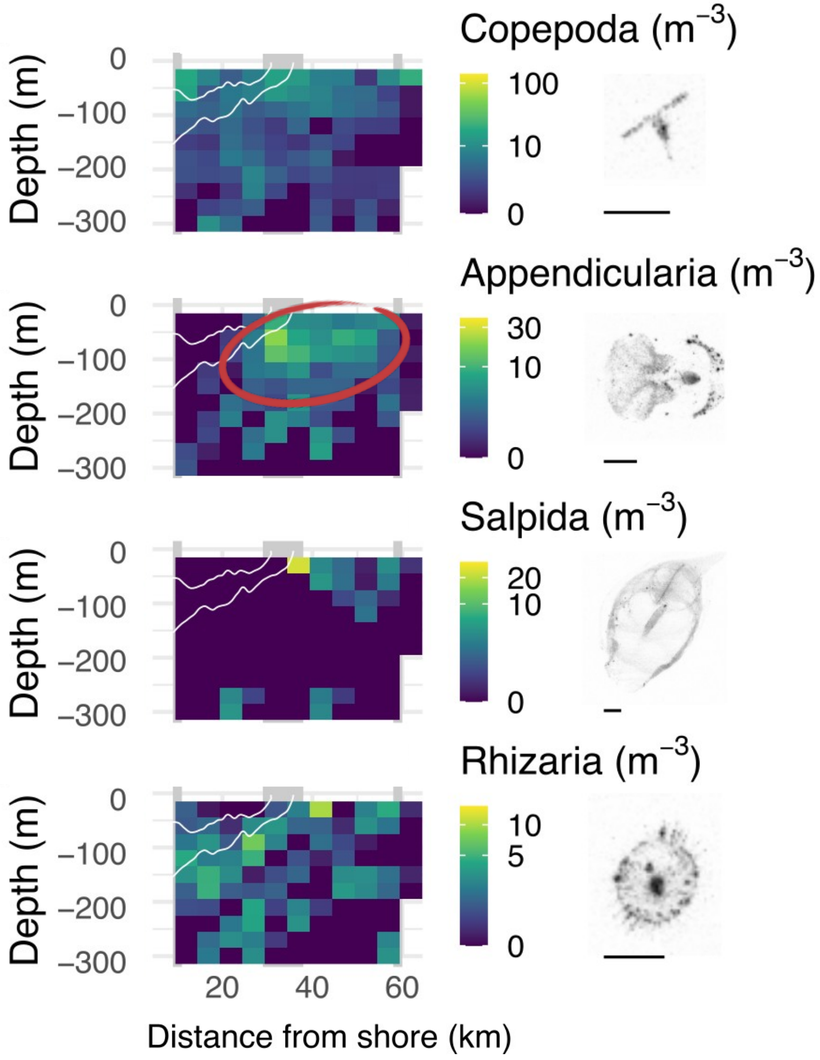




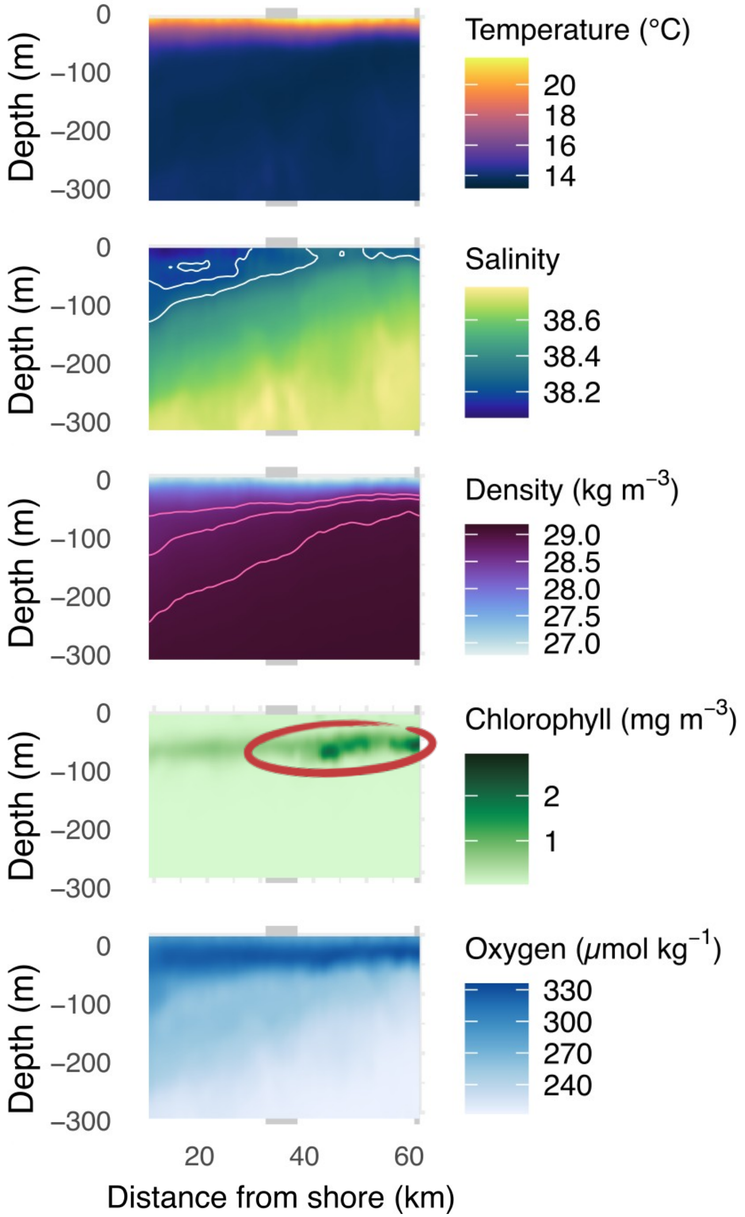
Very few particles

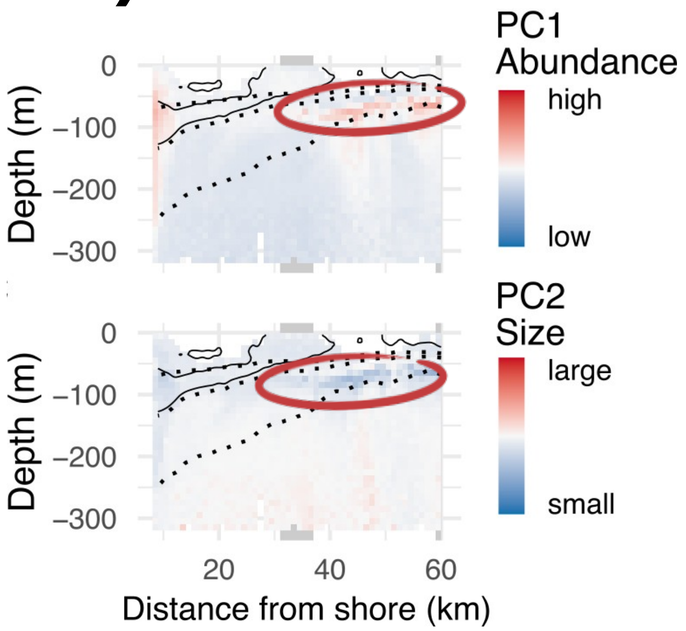
Salps → Appendicularians

Discarded houses



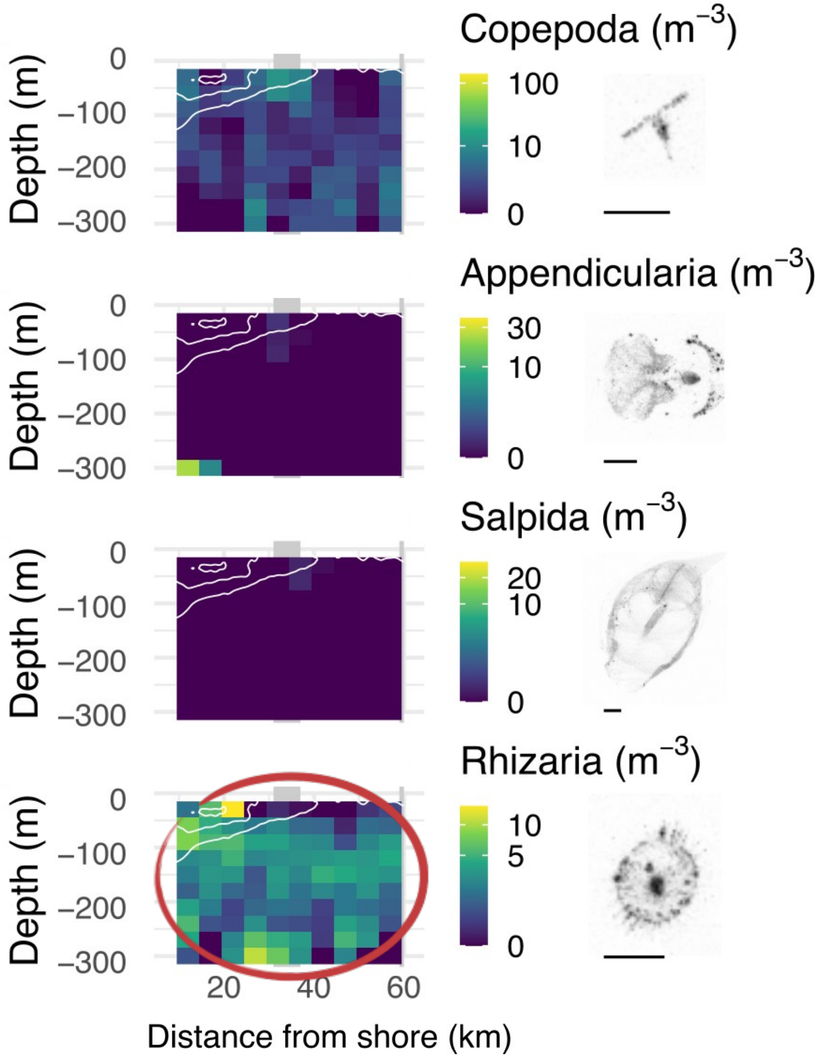
4: Post bloom (late June)





Effect of DCM on particle distribution

Rhizaria



Limitations

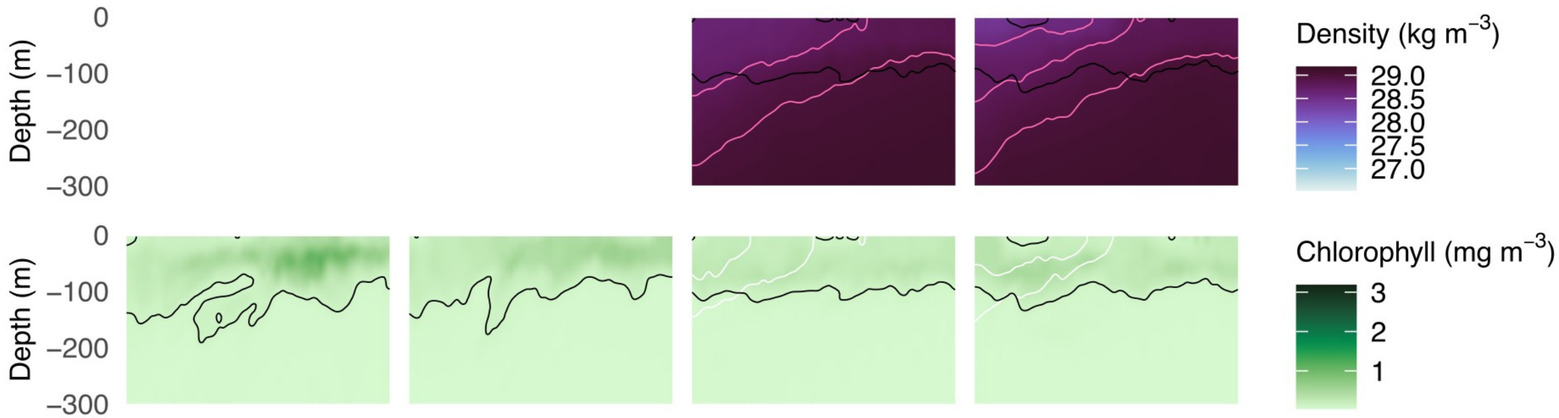
Some **instrument failure** (e.g. no CTD for ~15 days)

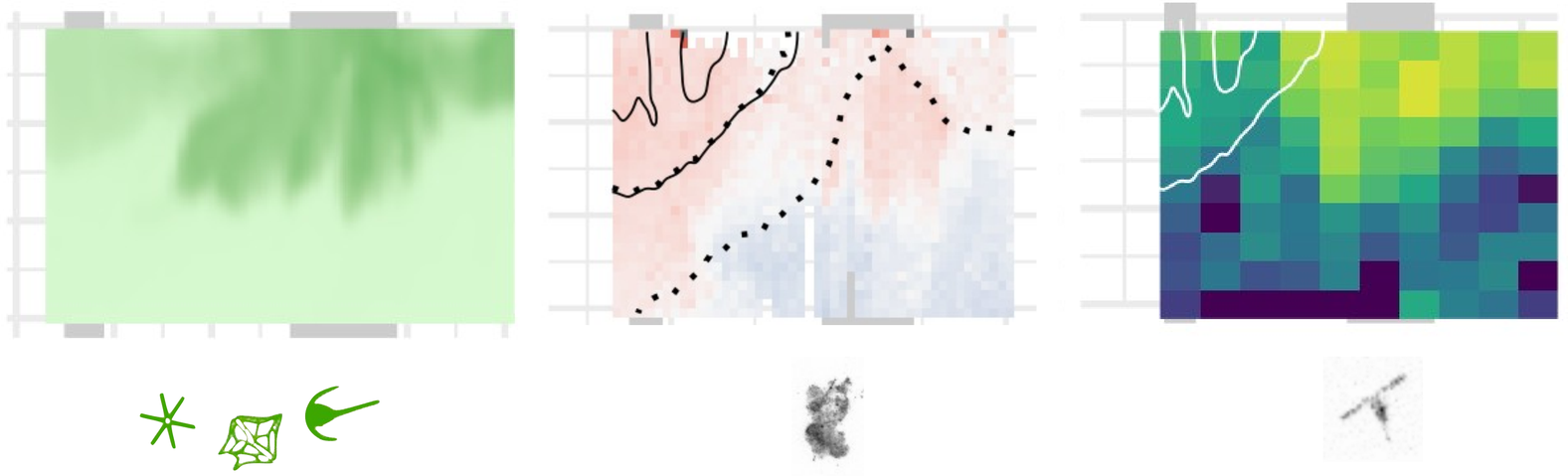
Limited **taxonomic** resolution from images and **imperfect** automated classification (>90% total accuracy but ~70% on living organisms)

Not enough organisms ⟹ lower resolution in biological concentrations than in particles/biogeochemistry

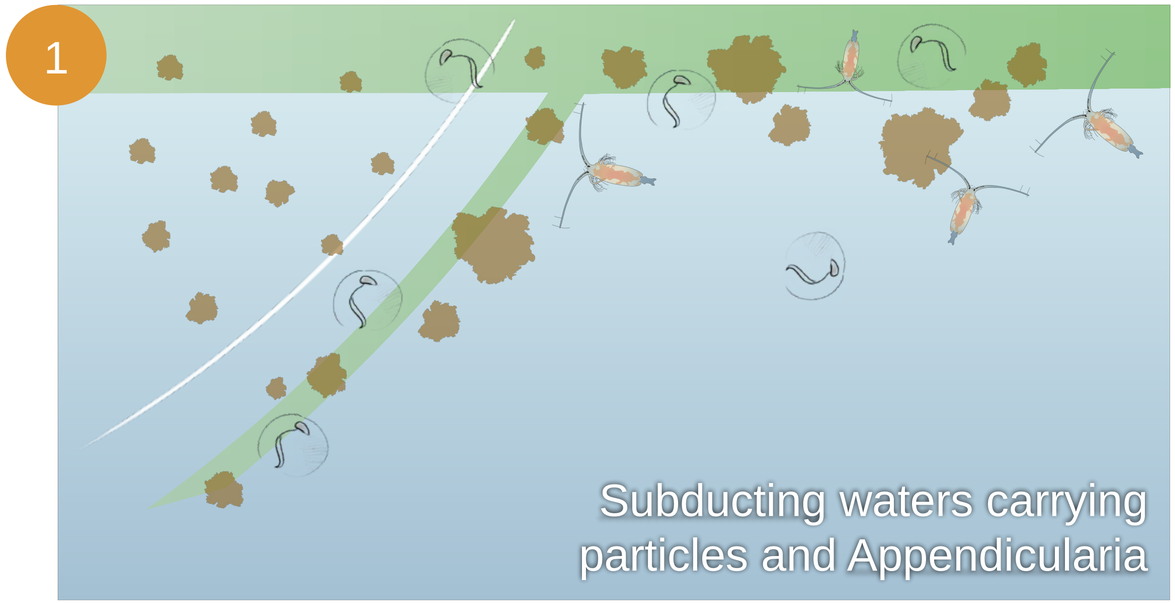
sampling rate of 0.25L/s but oligotrophic area

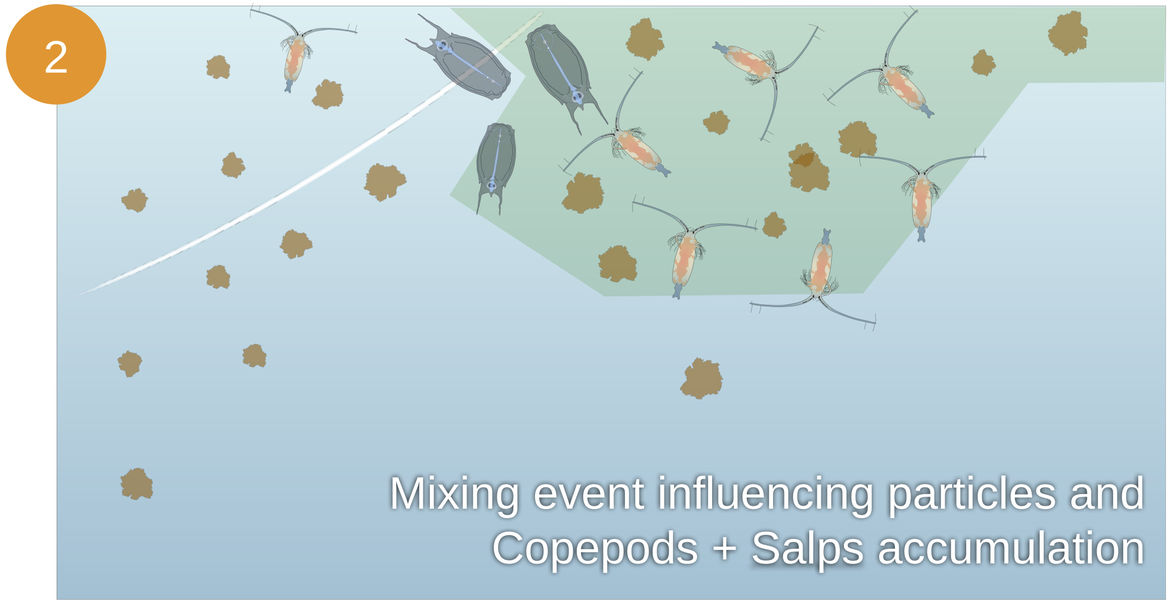
solution: UVP6 HF = less autonomy but higher sampling rate

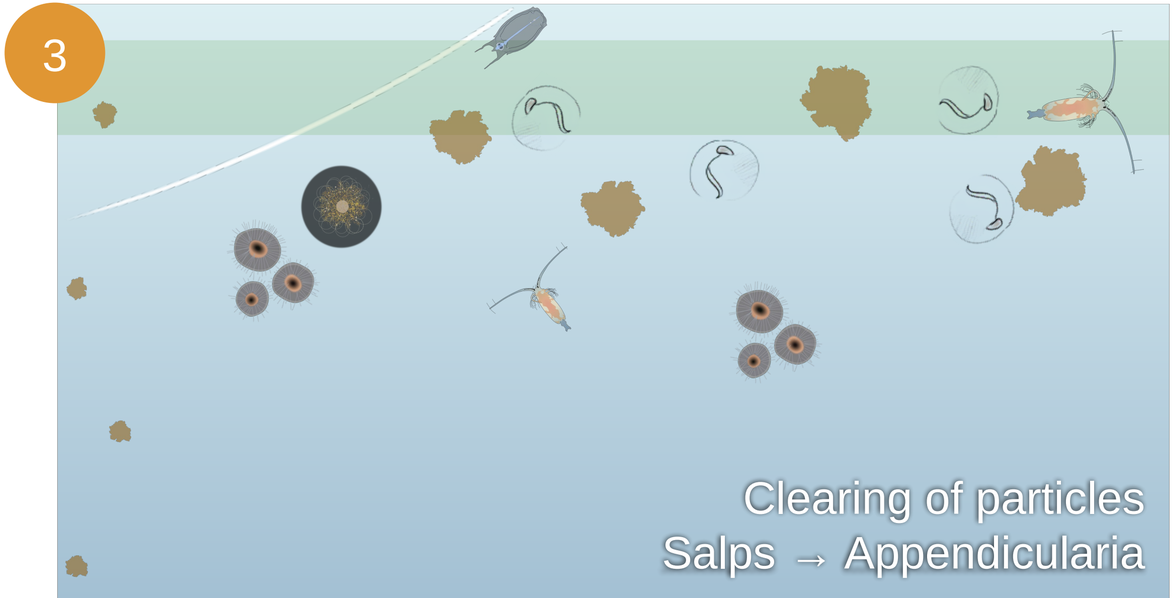


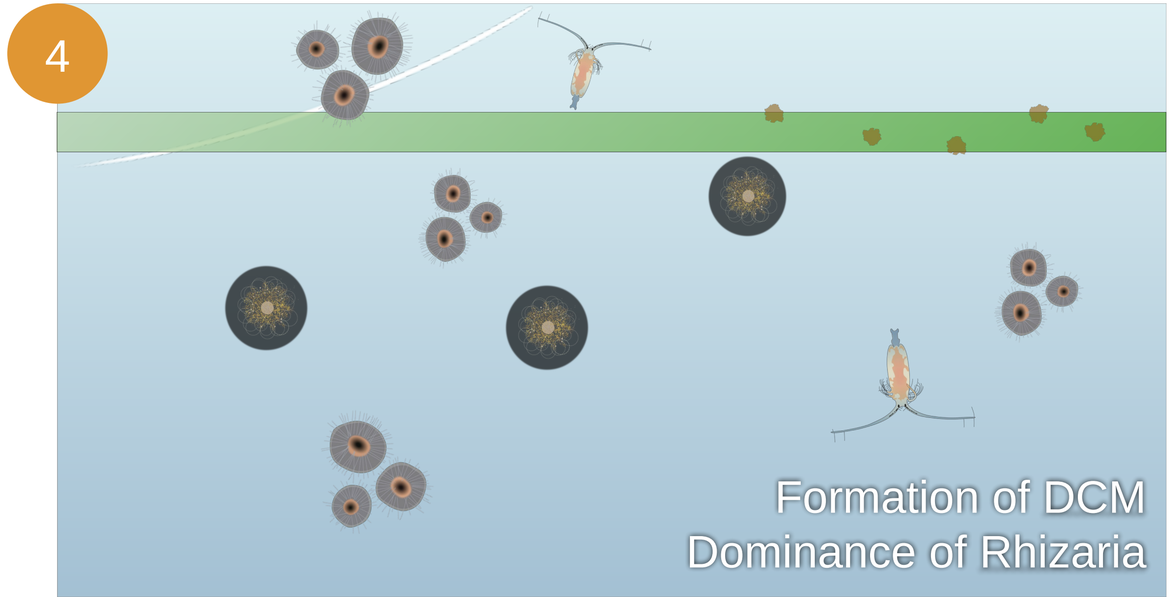


Summary: bloom dynamics









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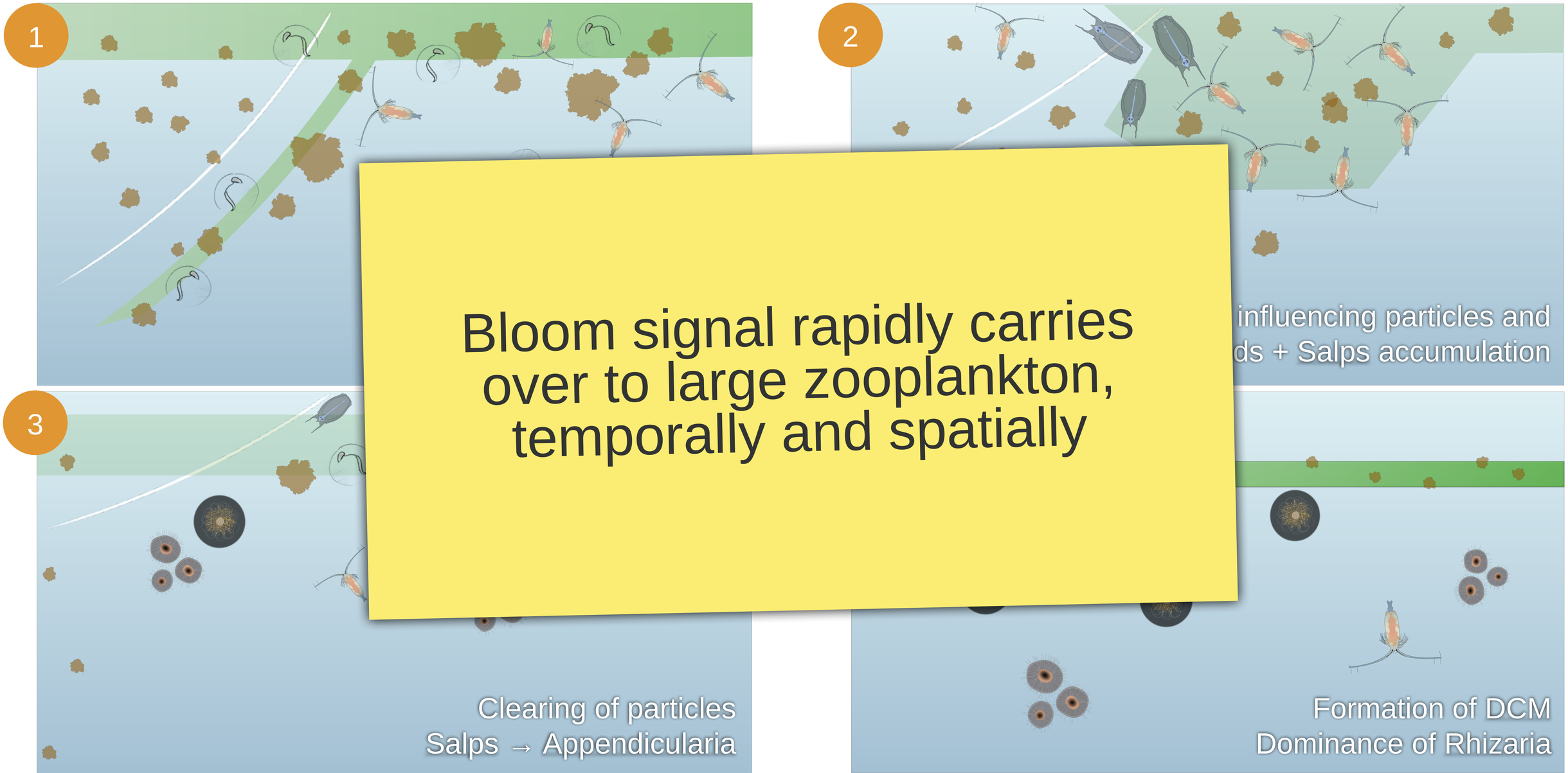

Bloom signal rapidly carries over to large zooplankton, temporally and spatially

thelma.panaiotis@imev-mer.fr

Thank you

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cnrs

SCIENCES SORBONNE UNIVERSITÉ